

Grid Connected Wind Generator

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Abstract: Injection of wind power into an electric grid affects the power quality and reactive power issues at the connected electric network. Power quality problems such as voltage sag and swell are some major concern. In this paper these issues are analyzed. Wind turbine connected to squirrel cage induction generator is modeled using PSCAD simulation software to analyse the said issues where STATCOM is introduced as an active voltage and reactive power supporter to increase the power system stability. STATCOM unit is developed to inject reactive power for mitigation of power quality problems and to get stable grid operation.

Keywords - *Squirrel Cage Induction Generator (SCIG); PSCAD; Wind Turbine Generator (WTG); Static Synchronous Compensator (STATCOM); Power Quality.*

1. Introduction

As the wind power penetration into the grid is increasing quickly, the influence of wind turbine on the power quality is becoming an important issue. Wind power penetration is the impact on power system stability. In order to avoid the necessity of developing a detailed model of a wind farm with tens or hundreds of wind turbines and their interconnections, aggregated wind farm models are needed [1]. From each generating station the probability of the total generating capacity not exceeding a given power level. This gives a measure of the reliability of the system [2]. If the network is weak this situation will cause a voltage collapse to occur in the transmission system. The process can be dynamically supported by a STATCOM to improve voltage stability and to improve recovery from network faults and mitigate voltage flicker [3]. Frequently wind parks are connected to weak systems, as they are typically located far from major load centres and central generation. This reflects itself in the short circuit ratio (SCR) of the interconnection. For weak systems the SCR will usually be less than 6 having over speed of generator [4]. Reactive power is the most important aspect in today's condition. Reactive power consumption in a Wind farm is mainly due to the use of induction generators for energy conversion. The basic principle of induction generator is that they consume reactive power in order to generate real power. The magnetizing currents drawn by step up transformers also contribute to reactive power consumption to some extent. This reactive power consumption leads to increased T & D losses, poor voltage profile over loading of T & D equipment and blocked capacity and over loading and

reduction in life of T & D equipment [5]. As a result, utilities typically disconnect the wind turbines immediately from the grid when such a contingency occurs. With the rapid increase in penetration of wind power in power grids, tripping of many turbines in a large wind farm during grid faults may begin to influence the overall power system stability [6].

Considering the increasing share of wind generation interfaced to grid it is necessary to study an overall prospective on various types of existing wind generator systems and possible generator configuration, critical power quality issues, problems related with grid connections [7]. Use of more intelligent controller for STATCOM and its interface to large power systems addressing various issues such as security, stability, and voltage profile improvement and power quality [8]. It was found that STATCOM considerably improves the stability during and after disturbances especially when network is weak [9]. FACTS devices provide an effective means of dynamic voltage control of wind farm, dynamic power control of the transmission lines, improving power oscillations damping and transient stability [10]. As the speed during induction generator operation is not synchronous, it is also called an asynchronous generator. Variation in "s" changes both active power and reactive power flow at the SEIG terminals there by simultaneously changing both terminal voltage and frequency of the Self Excited Induction Generator [11]. The use of STATCOM shall be considered for stability improvement as well as improvement of power quality taking considering techno economic aspects [12].